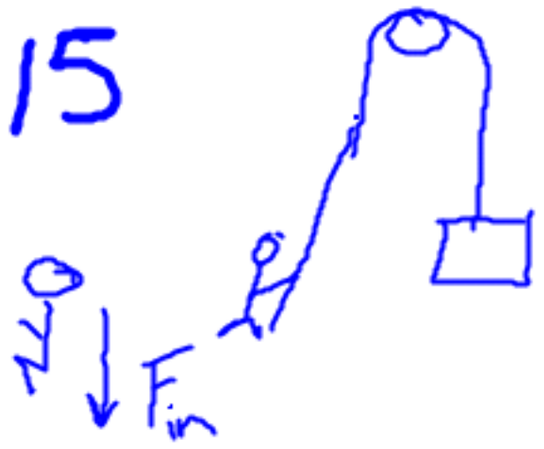
Machine: A device that helps do work by changing the magnitude or direction of an applied force.
usually makes doing the work easier by reducing the amount of force applied necessary.

Actual Mechanical Advantage (AMA) $= \frac{\text{Force (out)}}{\text{Force (in) (effort)}}$

Ideal Mechanical Advantage (IMA) $= \frac{\triangle d_{\text{(in) effort}}}{\triangle d_{\text{(out)}}}$

Efficiency $= \frac{\text{AMA}}{\text{IMA}} \times 100 = \%$ or $\frac{\text{Work (out)}}{\text{Work (in)}} \times 100 = \%$

8 $AMA = \frac{\text{Force (out)}}{\text{Force (in)}} = \frac{3000\ N}{200\ N} = 15$



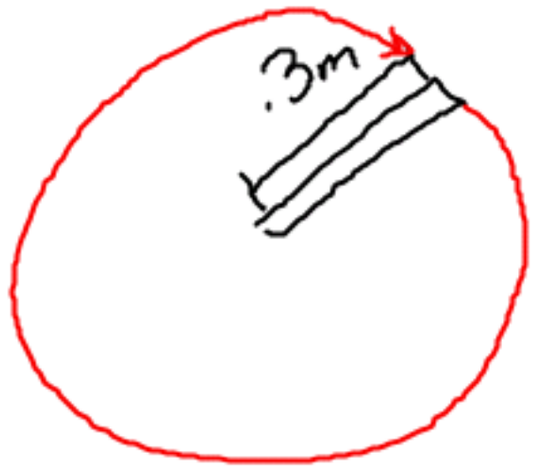
9.

- a) $IMA = \frac{\Delta d\ (in)}{\Delta d\ (out)} = \frac{2.4}{.8} = 3$

b) *Assume Efficiency is 100% $1 = \frac{\text{Work (out)}}{\text{Work (in)}} = \frac{F_{(out)} d_{(load)}}{F_{(in)} d_{(appl)}}$

$F_{out} = 2550\ N$

10.



$\triangle d_{in} = 2\pi r$

r = Length of handle

$\triangle d_{out}$ =

$$IMA = \frac{\triangle d_{in}}{\triangle d_{out}} = \frac{2\pi(30)}{2} = 94$$

4.

a) $IMA = \frac{\Delta d_{in}}{\Delta d_{out}} = \frac{2\pi r^{(.4)}}{2\pi r_{(.1)}} =$

b) $AMA = \frac{F_{out}}{F_{in}} = \frac{60N}{20N} =$.

c) $Eff = \frac{AMA}{IMA} = \frac{3}{4} = 75\%$

$Eff = \frac{Work_{out}}{Work_{in}} = \frac{F_{out}\Delta d_{out}}{F_{in}\Delta d_{in}}$

5. a) $10 = IMA$

b) $7.8 = AMA$

c) $Eff = \frac{7}{10}\%$

Exercise 11

$F_{out} = 460\ N$

$F_{in} = 60$

$$AMA = \frac{460}{60}$$

$$= 7.67$$

15.

a) 6

b) 4.4

c) 73%

$$IMA = \frac{d_{in}}{d_{out}} \quad \frac{6}{1} = 6$$

$$AMA = \frac{2200}{500} \quad \frac{F_{out}}{F_{in}} = 4.4$$

$$eff = \frac{4.4}{6} \quad 73\% = \frac{AMA}{IMA}$$